

CLAIMS

What is claimed is:

5 1. A system for storing and retrieving elemental hydrogen, said system comprising a hydrogen storage member comprising silicon.

10 2. A system in accordance with Claim 1 wherein the hydrogen storage member includes porous silicon.

15 3. A system in accordance with Claim 1 further comprising:
a) a housing for enclosing said hydrogen storage member; and,
b) a control system for regulating said storing of hydrogen into and said retrieval of hydrogen from said storage member.

20 4. A system in accordance with Claim 1 comprising a plurality of said hydrogen storage members.

25 5. A system in accordance with Claim 1 wherein said hydrogen storage member includes a porous silicon surface layer over at least a first portion of said hydrogen storage member.

6. A system in accordance with Claim 5 wherein the percent void volume of said surface layer is about 50%.

25 7. A system in accordance with Claim 5 wherein a second portion of said hydrogen storage member includes electronic integrated circuit elements.

8. A system in accordance with Claim 1 wherein said hydrogen storage member includes silicon columns.

9. A system in accordance with Claim 8 wherein said columns have an
5 aspect ratio of length to diameter of at least 10.

10. A system in accordance with Claim 8 wherein said silicon columns have been formed by extrusion of molten silicon through an orifice.

10 11. A system in accordance with Claim 10 wherein said extrusion is carried out by at least one of pressure, gravity, centrifugal force, and combinations thereof.

15 12. A system in accordance with Claim 10 wherein said orifice has a diameter of about 1 nm.

13. A system in accordance with Claim 12 wherein said orifice is formed in a shape selected from the group consisting of triangle, rhombus, square, and circle.

20 14. A system in accordance with Claim 10 wherein said extrusion is carried out in an atmosphere containing gases selected from the group consisting of hydrogen, argon, helium, and neon.

25 15. A system in accordance with Claim 1 further comprising a releasing source for releasing said stored hydrogen from said member.

16. A system in accordance with Claim 15 wherein said releasing source means for releasing is selected from the group consisting of light, current, voltage, and combinations thereof.

5 17. A system in accordance with Claim 16 wherein said light is provided by a light-emitting diode.

18. A system in accordance with Claim 16 wherein said light is provided at a wavelength of about 660 nanometers.

10 19. A system in accordance with Claim 1 wherein said silicon is in a monocrystalline form.

15 20. A system in accordance with Claim 19 wherein said hydrogen storage member is formed from a silicon wafer.

21. A system in accordance with Claim 1 wherein said silicon is in a polycrystalline form.

20 22. A system in accordance with Claim 1 wherein said silicon has been treated by a process selected from the group consisting of crushing, milling, treatment with hydrofluoric acid and methanol in the presence of electric current, treatment with potassium hydroxide, treatment with hydrazine, wet etching, dry etching, electrodeposition of a noble metal such as palladium or platinum, conformal vapor deposition of silicon, and non-conformal vapor deposition of silicon.

25 23. A system in accordance with Claim 1 wherein said silicon is derived from molten silicon by crystallization.

24. A system in accordance with Claim 1 wherein said silicon is derived from silicon waste from the integrated circuit industry.

25. An auxiliary power unit for generating electrical power, comprising:

- 5 a) a fuel cell system for combining hydrogen and oxygen to provide said electrical power; and
 b) a system for storing and retrieving elemental hydrogen for supplying hydrogen to said fuel cell system, said storing and retrieving system comprising silicon.

10 26. An auxiliary power unit in accordance with Claim 25 further comprising a control system for controlling the operation of said fuel cell system and said hydrogen storage and retrieval system.

15 27. An auxiliary power unit in accordance with Claim 25 wherein said fuel cell system is selected from the group consisting of solid oxide fuel cell system and proton exchange membrane system.

20 28. A vehicle comprising an auxiliary power unit including a fuel cell system for combining hydrogen and oxygen to provide said electrical power, and a system for storing and retrieving elemental hydrogen for supplying hydrogen to said fuel cell system, said storing and retrieving system including a hydrogen storage member comprising silicon.

25 29. A vehicle in accordance with Claim 28 comprising a plurality of hydrogen storage members, wherein various of said plurality are distributed into various locations within said vehicle.

30. A vehicle in accordance with Claim 29 wherein said locations are selected from the group consisting of floors, fenders, quarter panels, rocker panels, doors, columns, posts, trunk, roof, and combinations thereof.

5 31. A method for extruding silicon rods, comprising the steps of:

- a) providing a reservoir for receiving molten silicon, said reservoir having a wall;
- b) providing a plurality of apertures in said wall;
- c) subjecting said molten silicon within said reservoir to at least one of pressure, gravity, and centrifugal force to cause molten silicon to be extruded in rod shapes

10 through said apertures.

32. A method in accordance with Claim 31 wherein said apertures are formed of material selected from the group consisting of tungsten aluminide, aluminum oxide, diamond-like carbon, silicon carbide, and combinations thereof.

15 33. A method in accordance with Claim 31 wherein said apertures have a nominal diameter of about 1 nanometer.

20 34. A method in accordance with Claim 31 wherein said apertures are formed in a shape selected from the group consisting of triangle, rhombus, square, and circle.

25 35. A method in accordance with Claim 31 wherein said extruding is carried out in an atmosphere including gases selected from the group consisting of hydrogen, helium, argon, and neon.

36. A method in accordance with Claim 31 wherein said apertures are formed in said reservoir wall by a process selected from the group consisting of electron

beam etching, conventional photolithography, micromachining, molding using the lost-wax technique, stamping, etching, and combinations thereof.

37. A method in accordance with Claim 31 wherein said diameter of said
5 apertures is selected such that said rod shapes are extruded having a diameter equal to
an integral multiple of the lattice spacing of silicon.